Ability to reopen dormant fields

a) Moldboard or disc plough	A turning plow can go deep enough to dig out the roots and cover the weeds as it inverts the soil.
b) Cultivator	In overgrown or hard fields, a cultivator functions only slightly better than a country plough.

Long use season

a) Tractor	A tractor can be kept busy most of the year for tillage, threshing transport, and land levelling.
b) Walk behind reaper	May only be used for harvesting grain. The expensive power unit remains idle the remainder of the year. It may require as much as 200 hours use per year to justify the purchase of any engine.

Recommendations on Various Forms of Farm Mechanization

1. Water lifting justifies considerable attention. One major Afghan trader, with whom VITA has been working for the last two years, estimates that the 15 main traders sold 2,500 diesel engine pumpsets in Afghanistan in 1988. Half of these were powered by the PECO 12 hp water-cooled diesel engine made in Lahore. Ittefaq in Lahore makes a similar unit. There is some merit for staying with a name brand Pakistan made unit for parts availability as the Chinese have done a poor job of standardization. About one-third of the pumps were powered by 5 hp Japanese air-cooled petrol engines made by Honda. The remainder were 6.5, 7.5, and 10 hp water-cooled diesels from India. If VITA directly imports any engines from India they should get the premium quality engines from Kirloskars in Pune. They are also an ideal source of quality pumps. Pumps promoted by VITA should include in their specifications the suction lift height in addition to pump inlet and outlet pipe sizes. While not an expert in pumps, I believe that one of the principal VITA suppliers is selling large inlet and outlet sizes which are visible and a sales feature while sacrificing the distance the pump will lift. Many Indian pumps will lift water at least 20 feet below the pump.

The competition between pumpsets and karezes justifies a thorough on-site evaluation and may require a visit by a competent hydrologist when travel to Afghanistan beomes feasible. Annual snow melt from the mountains may provide aquifers of high capacity or they may be subject to rapid draw-down by competing pumpsets. VITA is certainly justified in rejuvinating karezes and repairing irrigation canals.

Persian wheels for lifting irrigation water are one of the best uses I have seen for bullocks, camels, or donkeys. There are many of them in use east of Peshawar. If they are in use in Afghanistan, their repair should be encouraged. However, I would not try to promote them as a new technology because new Persian water wheels are a poor investment relative to pumpsets.

2. The best form of mobile farm power for Afghanistan is the Massey-Ferguson 240 Tractor. This is the most widely used brand and model (240, 135, 35) of tractor in the world. It is large enough for all farm tasks as it is similar in size and weight but has twice the power of the tractors used in America when farmers switched from horses to tractors. Afghan farmers from Kabul to Herat have shown a preference for MF tractors. Spare parts availability should be assured for the future because MF tractors account for over 50% of current sales and also over 50% of all tractors on farms in Pakistan. This is likely to continue as Millat Tractors is a well run government concern with long term Pakistani management. While VITA should concentrate on the MF 240 as the primary tractor to get enough population to justify availability of service and spare parts, competition is also desirable. This can be left to the traders and farmers as they will also import the other tractors available in Pakistan such as the MF 375, Fiat 480, Fiat 640, and in the northern areas, the Belarus MTZ-50.

A major Afghan trader thinks about 3-400 Belarus tractors from Russia were sold primarily in northern Afghanistan in 1988. The tractor with 9 tyne cultivator, trolley, 2-bottom moldboard plow, and rear blade cost the Afghan farmer only Rs. 110,000 (versus Rs. 170,000 in Pakistan) and only required a 25% down payment to the Afghan Agricultural Development Bank. The trader estimates that Afghan farmers buy 10-12 tractors per month in Pakistan. I think this figure is low for the total purchases in Lahore, Peshawar, and Quetta. If the border becomes more open after the war I think there will be a brisk trade in tractors and implements via two routes; the Afghan trader who buys in Pakistan and has agencies in several towns in Afghanistan, and the Afghan farmers who come to several locations in Pakistan and buy for cash.

A tractor must work many hours per year to make it pay. Early adopters of tractors in India who worked only on their own farms required about 15 hectares of irrigated land growing two crops of improved varieties to make them pay. However, today custom work accounts for most tractor use. The Farm Machinery Institute at Islamabad estimates that the average tractor in Pakistan is used on 17 farms. VITA estimates that in Afghanistan where land holdings are smaller, a tractor would be used on approximately 20 farms.

Many attempts have been made throughout the world to make

and sell lower cost tractors which must have lower power. There has been essentially no success in Pakistan with this strategy. After a long struggle, power tillers or walking two-wheeled tractors are beginning to sell in India in rice producing areas, if a second crop such as potatoes can be grown by use of the tractor. There has been no success in wheat for either walking or riding tractors which have less than two-thirds the power of the MF 240. Thus low-powered tractors need not even be tried in Afghanistan if single crop wheat is the only crop to pay for them. 12 hp Chinese tractors of both the 4-wheel riding and the 2-wheel walking versions are available on the Pakistan market. Users of these tractors should be found and interviewed. It may be that as a Phase 2 program* after a couple of years that one or both of these tractors could be tried in hilly areas growing high cash value horticultural crops.

US-AID is working on converting pack mules to farm draft power. However, it appears to me that farmers who are willing to make a change in their farm power and cultural practices will want to move up to tractors.

Bullocks will remian the principal farm power ro most parts of Afghanistan for the foreseeable future. However, sales of replacement animals for those lost in the war is best handled by private traders.

3. Tillage is the most difficult work the bullock must do. Thus the cultivator or tyne tiller is the first implement the new tractor owner buys. VITA should demand hardened shovels and springs on any cultivators they buy. Mounted offset disc harrows do a similar tillage job better. However, they cost twice as much and have had few sales in Pakistan. In India about one-third of all tractor owners choose the disc harrow over the cultivator so it must be considered as a Phase 2 implement for adoption in a few years.

Less than 10% of tractor owners in India or Pakistan use moldboard ploughs. However, a very small survey indicates they may be more popular in Afghanistan. They certainly have some merit for reclaiming dormant fields. If the market exists, their use should be supported. For durability of soil working parts, VITA should buy only imported units. If plugging up with crop residues is not a problem, the low cost Italian bar-point moldboard plows should be a good value. If coulters are

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* Various specific recommendations are categorized throughout this report as Phase 1, Phase 2, or Phase 3. Phase 1 priorities are suitable for immediate adoption. Phase 2 priorities will not be feasible immediately but may become feasible after a few years of development. Phase 3 will require some time before economic and other consideration justify their use in post-war Afghanistan.

required, American ploughs would function well but repairs would be difficult in the future. Alternatives that eliminate the trash problem include burning, using a disc harrow before ploughing, or using an American made, heavy duty, 5-foot rotary cutter. This later unit from Bushhog, Woods, or John Deere will take out brush up to 3" in diameter. It is great for clearing land but I see little long term use for such a machine in a land that is short of fuel and fodder for its animals.

Pakistan made chisel plows with heat treated chisels could reduce problems of hard pans. Unless the results are dramatic, however, farmer adoption will be low so this should be considered a Phase 3 priority item.

4. There is already beginning to be a demand for threshers in Afghanistan (which VITA has nurtured) and it will grow as tractors become more available. One of VITA's major suppliers estimates that 3-400 Pakistani threshers were sold to Afghan farmers in 1988 and that the future demand will rise to 1,000 units annually. The Batala and other similar Pakistani built threshers are one generation behind the functional performance of the majority of wheat threshers currently sold in India. Manufacturing quality, however, is similar to that of India with some Pakistani manufacturers now using some sealed bearings to minimize servicing and reduce parts failures. Over half of all Indian threshers are powered by electric motors or diesel engines already owned for pumpsets. Small threshers are not available in Pakistan, because farm sizes are larger and canal irrigation is more prevalent than in India. The sale of 2,500 engine driven pumps in Afghanistan last year indicates there will be a significant number of engine owners without tractors. Thus, at least as a Phase 2 program, small and efficient engine powered threshers should be tried in Afghanistan. VITA should take whatever steps are required to get at least one or more samples of tractor power-take-off threshers and the smaller engine driven threshers from India. Alternative possible procurement sources include:

1. US-AID India sends threshers to US-AID Pakistan with government approvals.
2. US-AID India ships threshers to the Middle East. AMEG buys repainted threshers from the Middle East.
3. Farm Machinery Institute, Islamabad obatains a sample of each thresher from Dr. Ojha, Central Institute of Agricultural Engineering, Bhopal, India as samples as a part of an approved United Nations program known as RNAM. (Regional Network for Agricultural Machinery)
4. I work on such a shipment while attending the RNAM Conference in Bangkok 16-19 February.

Disposition of the smaller engine driven threshers by Batala owned by VITA remains an issue. Their head mechanic came to Peshawar, installed a smaller V-belt pulley on the main cylinder shaft and was able to adjust the thresher to get quite acceptable functional results in stored wheat that was more damp than is normally true in India. To do this he ran the MF 240 engine speed at 2100 rpm versus its more normal threshing speed of 1700 rpm. The resulting grain was clean, losses were insignificant, and the bhusa of good quality. Capacity was measured at 210 to 262 kg per hour which is low considering that feeding had to be slowed at times as the tractor was overloaded. It is difficult to ascertain how much of the low feed rate can be attributed to the damp straw. If I were trying to improve on it, the first thing I would do would be to reduce the clearance between the cylinder and the concave from its current 3/4"(?) to 1/4-3/8". This might reduce power consumption by getting the bhusa to pass through faster. Bhusa quality would have to be checked. My recommendation would be that no further attempt be made to run these threshers with portable engines of any size. Instead the small threshers currently in VITA's stock should all be converted to tractor use by having the Batala mechanic install the smaller cylinder pulley and check each machine for complete parts, adjustments and lubrication. VITA personnel sould be working with him to speed up his efforts and for training purposes. These threshers will always be less efficient than those originally designed for tractor power, because the cylinder has been shortened and the feed opening is only 36" wide. Thus, even dwarf wheats can not be thrown in crosswise as is normal. An alternative to reworking these smaller threshers to accommodate tractor power instead of a small engine is to scrap them or sell them locally in the Peshawar area where good threshers are less known.

Safety is an unrecognized problem with power threshers in Pakistan. The powershaft itself, for example, looks innocent but will remove a man's leg or arm is less than 2 seconds. The danger is compounded here by the local habit of wearing loose fitting clothes throughout the sub continent. One minimal step VITA could take would be to run ropes from the tractor fenders back to the thresher frame on each side of the powershaft to prevent people stepping over it when it is in operation. Exposed belt pulleys are also a problem but they are more likely to remove fingers than arms or legs.

5. Trolleys or trailers account for about half of farm tractor use in Europe and probably two-thirds of South Asia due to their being fewer lorries and worse roads. Single axle trolleys are preferred here, because they are much simpler to back up and maneuver. VITA has a responsibility to match their trailers to the size of their tractors. The weight of the loaded trolley should never exceed twice the weight of the tractor if the tractor is to have long life and the brakes and sterring of

the tractor are to be adequate to protect the life of the driver. The unit purchased from JECO appears to be well designed and of high quality manufacturing. Conversely the large trolleys based on used lorrie components should be returned to AMEG for their disposal. Trolleys of this size are used in the Peshawar area on level land for hauling sugar cane to the mill, but they are a gross overload on the tractor.

Future trolley hitches obained for the MF 240 tractors should permit the use of the powershaft for threshing while the hitch remains in place. Two Pakistana manufacturers were found that keep the thresher attached to the tractor when it is operated. This practice should spread because it saves so much time for the custom operator.

Another item which VITA should purchase with each future tractor-trolley combination is a Jib Crane (available from Millat for Rs. 5,000.) This amount can easily be saved in reducing damage to other implements as they are loaded off and on the trolley to move from one location to another. The unit is very simple and attaches to the 3-point hitch of the tractor. One should be ordered immediately for the storage area for loading and unloading lorries. Others should be ordered as necessary.

6. Several farm machines used for irrigated land preparation in Pakistan should be valuable in Afghanistan. The best selling tool here is the rear blade. A simple version of it should be included with each tractor sent into Afghanistan. The front blade is considerably more effective, but it's more difficult to mount and its triple price make its adoption a Phase 2 item. If a farmer were doing only custom levelling, its price would be justified. However, it is more likely to damage the tractor than the rear blade. Phase 3 tools include border discs, land levellers, ridgers, ditchers, and dirt scrapers.

7. Seed and fertilizer application equipment are important but must be considered as Phase 2 items. Good combination seed and fertilizer drills for wheat and some other crops are available in Faisalabad. Some manufacturers furnish separate drills for cotton or maize but I would be inclined to try to use the same drill for all three crops if the machine is being used successfully in Pakistan. Wider rows for cotton and maize are obtained by closing off some of the meters. The fluted feed seed meters have oversize flutes to accept the larger seeds which means some compromise in uniform seeding of wheat. However, the single drill should offer inproved seed distribution and depth control relative to the current Afghan system of broadcasting all seeds and "planking" for covering.

Tractor 3-point hitch mounted broadcasters are available in Pakistan for sowing seed or spreading fertilizer but I consider these of limited utility. Manually carried seed and fertilizer broadcasters were introduced in India but they have very low acceptance even though they save fertilizer, especially for the rice grower.

8. Reaping is one of the most difficult manual operations for the wheat grower. Chinese designed, tractor front-mounted reapers are beginning to be accepted in India. Pakistan appears to be ahead of India, both on the adoption of reapers and the quality of functional design and manufacture. Many reapers here use sealed bearings and imported cutting components and are of generally higher quality than the threshers. Manufacturers in Daska are switching from the traditional Chinese cross conveyor belts to the more maintenance free Japanese roller chain cross conveyor. Tractor mounted reapers are definitely Phase 2 priority items, but slow adoption rates of such machines in Pakistan suggests caution on trying mass introduction.

There may be some hilly areas of Afghanistan with fields, which are too small for tractor mounted reapers. Alternatives for mechanical reaping include the Japanese Kubota petrol engine walk-behind reaper, the Chinese diesel engine power tiller mounted reaper, or the Chinese Taishan 12 riding tractor with mounted reaper. Any of these rate no higher than Phase 3 for long term adoption due to their cost per unit of work accomplished. However, I think VITA should buy 3 to 5 Kubota reapers for exploration. There may be some unique micro-climates where wheat is inter cropped with high value horticultural crops where such reapers would have high utility and potentially high adoption rates.

9. Several post harvest stationery machines for use by the farmer, the village, or the town should be considered for Afghanistan. These include chaff cutters, maize shellers, rice hullers, flour mills and oil expellers. Hand powered chaff cutters have been in widespread use in India and Pakistan for decades to prepare fodder for draft and dairy animals. In 1988 in Pakistan their sales were double those of tractors. These are strong candidates for Phase 2 introduction in Afghanistan.

Good hand operated and tractor mounted maize shellers are available from Faisalabad but have recieved low adoption in Pakistan and so should be considered as a Phase priority 3 for Afghanistan. One of the VITA whole salers has also been selling flour mills with stones from India.

Rice huller technology should be examined by some one more knowledgeable than myself. There was a major program by Ford Foundation In India in the late sixties to get mills to switch from traditional rice hullers to rubber roll hullers because it increased the outturn of rice. These may already be available in Pakistan. If not, Dandekar of Bombay is a potential source for all sizes of rice milling equipment. Generally the saving of food already grown is more important than growing more food.

10. Road building and repair can be done entirely by hand or almost entirely by heavy equipment. Some equipment originally designed for farming might be considered as middle ground if the need is too urgent for hand labor alone. A good basic combination would be an MF 375 tractor with a rugged front blade. A chisel plough on the rear could loosen hard soil and small rocks. A drawn scraper could transport dirt from a cut to a fill. We explored loaders and backhoes with Millat Tractors and this is one instance where the imports they offer are entirely inadequate. Their imported loaders and back hoes were meant for farm use a few days per year and might wear out in a week on a road. However, a good industrial weight loader for an MF 375 was located at JECO in Gujranwala.

If a combination loader-backhoe is needed, it should be secured through Massey-Ferguson in the U.S., Canada, or England. The Perkins engine should be the same as the one in the imported MF 375 and possibly even the transmission should also be imported. Thus service and parts would be much more available.

<u>Summary</u>

Equipment for export to Afghanistan divides into two main categories. The first priority (Phase I) should be made available to prospective Afghan purchasers immediately. The second priority (Phase II) will require some preparation, market development and demonstrations. Phase II items will not be commercially adopted for several years.

<u>Phase I:</u> There is enough experience from Pakistan and India with reasonable confirmation from Afghanistan that those farmers who are economically able will purchase tractors, cultivators, trolleys, wheat threshers, rear blades, and a reasonable number of moldboard ploughs. Good quality, Pakistani made tractors, cultivators, trolleys, and rear blades are available from one or more manufacturers at reasonable prices. (See table on following page). Because even the best moldboard ploughs wear out, the ones currently imported from Italy should be used. Wheat thresher functional design needs to be updated at least to Indian levels. (VITA is currently working on this.)

Phase II: Disc harrows, seed drills, tractor reapers, and front blades are likely to be adopted eventually but will take considerable domonstration to prove their utility to the first time tractor user. Hand operated chaff cutters should also be demonstrated. These would appear to have considerable utility in Afghanistan, but for reasons which are not currently understood, they don't appear to be very acceptable in Afghanistan.

FARM MECHANIZATION IN PAKISTAN
14 February 1989
Roy E. Harrington

Machine	88 Sales	Sales as % of Tractors	Good Source(s)	Rs. 88-89
Farm Tractor	22,000	100	Millat MF 240	146,500
Cultivator	29,752	134	JECO, Gujranwala	7,200
			Millat, Local	7,888
W Thresher	25,000*	114	United AE, Daska	23,000
			Rachna, Faisalabad	29,000
Trolley	12,800*	58	JECO, Gujranwala	
			Millat, Local	23,500
Rear Blade	10,832	49	JECO, Gujranwala	3,000
			Naeem, Faisalabad	2,900
Seed Drill	3,202	15	Naeem, Faisalabad	11,000
MB Plough	2,440	11	Millat, Italy	9,500
Front Blade	1,815	8.2	JECO, Gujranwala	10,500
FM Reaper	1,346	6.1	Sayyed, Lahore	
			United AE, Daska	22,000
Disc Harrow	1,310	6.0	Millat, Local	15,000?
Cotton Drill	1,016	4.6	Naeem, Faislabad	
Border Disc	820	3.7	Millat, Local	9,400
Maize Sheller	704	3.2	Rachna, Faisalabad	6,500
Land Leveller	466	2.1		
Ridger	414*	1.9	Millat, Denmark	8,350
Chisel Plough	294	1.3	Millat, Local	11,500
Ditcher	270	1.2	Millat, Local	7,800
Scraper	155	.7		
Combine	25	.1	Unsuitable	
Chaff Cutter	42,754	194		
Disc Plough	NK	-	Millat, Italy	20,500
Jib Crane	NK	-	Millat, Local	5,000
Loader for MF 375	NK	-	JECO, Gujranwala	42,000
Kubota Reaper	NK	-	Doula FI, Lahore	25,000

*Sales are for 1984. Both 1988 and 1984 sales figures come from publications of the Farm Machinery Institute of NARC, Islamabad. Good sources and prices were obtained from factory visits to Lahore, Faisalabad, Daska, and Gujranwala. There are probably other equally good sources but each of the manufacturers listed demonstrated some unique interest in a quality product. Pump sources were not studied in sufficient detail to permit the inclusion of a properly informed opinion in this report.

FARM MECHANIZATION STRATEGIES FOR AFGHANISTAN

15 February 1989

Roy E. Harrington

1st draft —

FARM MECHANIZATION CONTACTS IN PAKISTAN
15 February 1989
Roy E. Harrington

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ADOPTION RATES OF FARM MECHANIZATION

Roy E. Harrington
1 February 1989

Machine	Pakistan		Cult=100% Base		India 1984
	Rs in 84	Sold in 88	Pakistan	India	# on Farms
Farm Tractors		22,000	74	160	881,000
Cultivators	3,200	29,572	100	100	550,000
W Threshers	16,500	25,000*	85	164	900,000
Trolleys	11,000	12,800*	43	73	400,000
Rear Blades	1,800	10,832	37		
Seed Drills	4,200	3,202	11	45	250,000
MB Plough	4,400	2,440	8.3		
Front Blade	4,900	1,815	6.1		
FM Reapers	14,000	1,346	4.6		
Disc Harrows	4,500	1,310	4.4	55	300,000
Cotton Drill		1,016	3.4		
Border Disc		820	2.8		
Maize Sheller		704	2.4		
Land Leveller	2,700	466	1.6		
Ridger	3,700	414*	1.4		
Chisel Plough	3,600	294	1.0		
Ditcher	3,000	270	.9		
Scrapers	11,000	155	.5		
Combines	115,000	25	.08	.6	3,100
Chaff Cutter		42,754	145	?	
Disc Plough					
3-Pt Scoop					
Loader-Backhoe					

NOTES

Information on Pakistan comes primarily from two publications by the Farm Machinery Institute of NARC, Islamabad. 1989 prices are distinctly higher than those shown for 1984. *Sales are for 1984. Information on India comes from four papers by industry and the Government of India.

Farmers in both countries have bought tractors to do those jobs which have traditionally been the main tasks for their oxen. These are tillage, threshing, and transport. The cultivator or tine tiller dominates in both countries but India also uses many offset disc harrows which are made locally with proper hardened discs. The majority of wheat in both countries is mechanically threshed. However, over half of all threshers in India are poowered by pumpset motors or diesel engines of 3-10 hp. Pakistan leads India in the adoption of rear blades and front-mounted reapers but India is ahead in the adoption of wheat seed drills.

PUNJAB CONTACTS ON FARM MECHANIZATION

Roy E. Harrington
31 January 1989

LAHORE

Sohail Bashir Rana General Mgr, Marketing Millat Tractors Ltd Sheikhupura Road P.O. Box 1147 Phone 711021-25	M-F 240 & 375 Tractors, Front Blade, Cultivator, Offset Disc Harrow, Disc Plough, M.B. Plough, Ditcher, Chisel Plough, Fertilizer Broadcaster. Imported Loader-Backhoe. Discuss sources of threshers, reapers, seed drills, 10 hp engines; machines on farms, annual production;sales & service in Afghan; tools & training needed for local mechanics.
Ittefaq Foundries Ltd 32 Impress Road Phone 711120 or 306-9615?	John Deere Combines, Thresher, Reaper, Pumps. Discussion similar to Millat plus source of Rubber Roller Rice Hullers.
Iftikhar Ali Malik Chief Executive Guard Group 80-Badmani Bagh Phone 200075, 200066	Yanmar Rice Transplanters & Combines, Filters & Brake Fluid for Tractors & Automobiles. Discuss imported Japanese 10 hp engines.
Asif Sharif Chief Executive Sargroh Farm Aids, Ltd 72, P Model Town (Ext) Phone 867072, 867073	Discuss best sources of threshers, reapers, chisel plough, M.B. plough, disc plough, disc harrow, ditcher, scraper, dirt scoop, subsoiler, imported 10 hp engines.
Nadeem Amjad FMI Engineer Sayyed Machinery Ltd 65, Shahrah-e-Quaid-e-Azam Phone 320131-5	Small mfg - <u>VITA Reaper</u>, M.B. Plough, FMI Combine. Discuss statistics, best machinery sources to visit.
Pakistan Engineering Co Badmani Bagh Phone ?	Medium mfg - AMRI Reaper, Pumps. Discuss 10 hp engine sources.
Bazaar	Light weight 10 hp engines.
Haji ~~M~~Inayatullah	Discuss how sales & service should be handled in Afghanistan.
Parvez Machinery	Same discussion as above.
GOP Census Office	1984 Agricultural Census, Tractor and Implements on farms.

DASKA

Mughal Farm Machinery Circular Road Phone 939	Medium mfg - Reaper, Thresher, MC Thresher, Rear Blade, Cultivator.
Green Land Engineers Circular Road Chowk Civil Hospital Phone 864	Small mfg - Reaper, Thresher,M.B. Plough Disc Harrow,Potato Planter, Ridger, Rear Blade, Cultivator, Trolley.
United Agro-Engineers Circular Road Phone 750	Medium mfg - Reaper, Thresher.
Sadaqat Industry Circular Road Phone 963(PP)	Small mfg - Reaper, Thresher, Trolley.

GUJRANWALA

Javaid Engineering Co G.T. Road P.O. Box 46 Phone 81343	Small mfg - Reaper, Front Blade, Cultivator, VITA Trolley.
Smith Engineering Co G.T. Road Climaxabad Phone 82744	Small mfg - Reaper, MC Thresher, Rear Blade, Cultivator.
Climax Engineering Co G.T. Road Climaxabad Phone 80211-4	Small mfg - MC Thresher, Cultivator.
Akhuwat Engineering Wks Khali, Sheikhupura Road Phone ?	Small mfg - Reaper.

FAISALABAD

Batala Industry Summandri Road Phone 41510, 42095	Small mfg - VITA Thresher, Maize Sheller, Cultivator, Sugar Cane Crusher.
Liquat Foundry & Eng Co Summandri Road Phone 27368, 41923	Medium mfg - Seed Drill, Cultivator & its springs, Rear Blade, Sugar Cane Crusher.
Rachna Industry Summandri Road Phone 22466, 22893	Medium mfg - Seed Drill, Thresher, Maize Sheller, Cultivator, Rear Blade, Sugar Cane Crusher.
Ittefaq Industry Summandri Road Phone 41960, 41961	Medium mfg - Reaper, Thresher, Maize Sheller, Cultivator, Chaff Cutter, Sugar Cane Crusher.
Punjab Engineering Co Summandri Road Phone 24415	Medium mfg - Thresher, MC Thresher, Cultivator, Sugar Cane Crusher, Chaff Cutter.
Naeem & Company Summandri Road Phone 27505	Small mfg - Seed Drill, Thresher, Land Leveller, Plough.
New Crown Industry Summandri Road Phone 42824	Small mfg - Thresher, MC Thresher, Maize Sheller, Sugar Cane Crusher.

NOTE

Most of the preceding information is based on December 1982 survey results published in a handbook by Farm Machinery Institute, Islamabad. An updated version is due later in 1989. All listed manufacturers have a shop with at least aDrill, Lathe, and Welder. Excluding land, small manufacturers have an investment of under.5 million rupees, medium have .5 to 5 million rupees, and large have more than 5 million rupees. Other import-ant manufacturing locations lie south and west of Lahore at Mian Channu, Bahawalpur, and Raheem Yar Khan, all in Punjab.

Introduction

My assignment dated 5 January 1989 was to work with Dr. A. Wakil, John Tacon, and others on tractors, threshers, reapers, and other farm machines suitable for Afghan farmers. I was to gather information from various sources including visits to factories in Pakistan.

The shorter the time a consultant is in the field, the more firm his recommendations can be. Mine can be even more firm because Afghanistan remains at war so I could not visit its villages, factories, repair shops or bazaars. Much of my recommendations must come from five years experience in India along with limited observations in Pakistan.

Food Production Technologies

Wheat farmers in both Punjab, Pakistan and the Northern part on India appear to have adopted new techologies in about the same sequence.

1. In the water deficit plains, the greatest single need is for assured water, first to help the crop survive and secondly to reach its maximum yield potential. Canal irrigation is important but the Sikh farmer in East Punjab prefers the independence of his own tube well. India now has over 10,000,000 pumpsets in use, powered by 3-5 horsepower electric motors or 5-10 hp diesel engines.

2. With assured water, the high yielding seeds offer distinctly higher yields than the desi or local varieties. Most wheat in both Pakistan and India is now the improved dwarf varieties.

3. High yielding seed varieties are not as tolerant of poor farming methods as the old varieties. Thus, improvements in cultural practices such as sowing depth, fertilizer placement, and timing of irrigation become more important to maximize yields.

4. The high yielding varieties show great response to the use of adequate fertilizer. Fertilizer use per hectare in East Punjab exceeds that of any wheat growing state in the U.S.

5. The farmer who has experienced the increases in income from the above changes is looking for more opportunities to grow more food on his land. Multiple cropping covers over half the land in three northern Indian states. Wheat is the normal winter or rabi crop with the summer or kharif crop divided between rice, corn, cotton and some other crops. I think the climate in much of Afghanistan will make it difficult to grow wheat and another field crop. Possibly some vegetables could be grown in the summer.

6. Multiple cropping is only possible if the first crop is removed from the field rapidly and the second crop sown in a short amount of time. Thus tractors have become very popular among wheat farmers in both Pakistan and India. The above improved practices provide the income needed to pay for tractor use and multiple cropping requires the timeliness of tractor power. While tractor power is the last of the six technologies to be adopted by farmers in the two Punjabs, it probably should come earlier in the sequence for many Afghan farmers. Punjabi farmers had bullocks to dispose of when they adopted tractors. Many returning refugees will have no bullocks but many will have learned something about the use of tractors, lorries, cars, etc. Most of Afghanistan will probably remain with bullocks for years to come but those who must start over should seriously consider tractor power.

Infrastructure for Market Economy Agriculture

The immediate need in Afghanistan is for increased food production. This will come primarily from those farmers who have already been in the market economy. While VITA must concentrate on those in the cash society of the market economy, they should exercise great care to minimize inappropriate concentration of wealth and power from their activities. Any intervention in another culture has its risks, but these can be reduced in this instance by selecting all farm machines and other inputs from proven performers in Pakistan. The supplier should have gained his livelihood from serving the Pakistani farmer well and expect to continue to have this as his main source of income. Thus, any boost given by VITA will also help both the Pakistani and the Afghan farmers. VITA may wish to continue providing some subsidies to selected Pakistani manufacturers of selected products. However, great care should be taken to see that these are available to many Afghan wholesale traders rather than giving preference to only a few. The percent of subsidies should be kept low to minimize distortions in the free market economy. There are a series of additional considerations which will affect the success of VITA's program to introduce improved technologies.

1. For Afghan farmers to adopt the preceding technologies they must have access to these purchased inputs at reasonable, dependable prices.

2. Afghan farmers who use pumpsets or tractors must also have access to service shops and repair parts.

3. Dependable credit at reasonable interest rates are needed both for crop production loans and for tractors.

4. Even before the crop is planted, the farmer should be confident that he will receive remunerative prices for his grain. This is essential if he is to take the risk of investing in added purchased inputs.

5. The farmer must also have access to the market soon after harvest. This requires both roads to population centers and availability of lorries. Tractors with trolleys can be used for shorter distances or on poorer roads.

Sources for Technologies and Infrastructure

The public sector in many developing countries takes the responsibility for both developing and supplying improved food production technologies. However, in the U.S. and in some other industrialized countries the private sector does much of the development and most of the supplying of purchased farm inputs. This includes irrigation equipment, high yielding seeds, fertilizer, and farm machinery. Governments in many countries have approached the long term improvement in their food production technologies with three somewhat equal programs for research, education, and extension. The urgency of the current situation in Afghanistan suggests a different strategy. The knowledge gained in wheat culture from research in Pakistan and India must be utilized with minimum adaptation. Those who are already educated will need to form the base for improved agriculture.

The area with the best cost/benefit ratio for VITA appears to lie in extension. Because of limited resources, VITA should examine each proposal for its multiplier effect. As the end user, the farmer must be reached with quality demonstrations of improved practices. Quality demonstrations require trained people who understand both farming and communication in the farmer's setting.

1. Assured water is the first need. VITA can help the local shooras in repairing canals and karezes. Private traders should handle pumps, engines and pipes for tubewells.

2. Provision of high yielding seeds is one of the more difficult problems. VITA can play an important role here by gathering information on varieties found suitable in the higher elevation, mountainous areas of Pakistan, India, and Turkey along with obtaining some of these seeds. Some might be sent in without further trials but as a longer term project some adaptive reasearch trials of varieties should be tried in the areas of use. When suitable varieties have been determined, VITA can work with private traders in getting these seeds distributed.

3. Since high yielding varieties often respond more to proper cultural practices, these practices also need to be studied in the mountainous areas where high yielding seeds have been adopted successfully. While I have not seen maize grown in Afghanistan I feel certain that seed could be saved and yields increased if it were sown in rows instead of broadcast. (A good source of knowledge about wheat varieties and cultural practices is Dr. Bill Wright, Management of Agricultural Research & Technology, Room 417, Pakistan Agricultural Research Council, L-13, AL-MKZ, F-7/2, Islamabad. Phone 812580-2517. He is a Winrock-USAID employee who has worked for about two decades in India, Turkey, and Pakistan.)

4. Fertilizer should be available from the market in Pakistan and might be handled by both the public sector and by private traders. For the forseeable future, the public sector in Afghanistan is likely to be a very weak and diverse group of governmental or semi-governmental bodies. In the context of this report the public sector means a group of leaders that the villager sees as being able to promote, permit, or prevent certain activities. VITA can provide some assistance by informing farmers as to the amounts of N,P, and K that offer the highest profit and how best to apply the fertilizer.

5. The scope for multiple cropping may be quite limited in Afghanistan but VITA should determine if there are places near population centers that could be growing vegetables in the summer between wheat crops. The Afghan government may be reluctant to reduce their wheat growing area in favor of export cash crops because they will want to remain self-sufficient in their basic domestic food crop. VITA can also help revitalize the Afghan fruit and nut tree industry for the local and export market as this is another way for the small land owner to have a reasonable family income.

6. The distribution and service of farm machinery belongs in the private sector. The development of farm machines should not be attempted by the Afghan government or universities. Rather they should depend on those developments that primarily have been proven on farms in Pakistan and secondarily on wheat farms in India or China. Suitable farm machines, their sources and prices are discussed later. In most instances, satisfactory machines are made in Pakistan but frequently require some imported components for soil working tools, reaper knives, bearings, etc. VITA can set a useful example in the selection of all the machines they use by getting the best value based on functional performance, work capacity, durability, ease of operation, ease of maintenance, safety, availability of spare parts & service, and cost. When others copy with look-alikes in sales or manufacture, quality goes down to reduce the price or increase the profit. Quality goes up when competition starts getting some of the manufacturer's sales because the competitor

has a better product. Since Pakistan is a good source for most of the Afghan farm machinery needs, it is highly desirable that there be few tariff or non-tariff trade barriers between the two countries. For those products that offer greater value from other countries, it is highly desirable that Afghan traders be permitted to trans-ship through Pakistan without restriction.

7. VITA has a unique opportunity to improve the service of farm tractors and implements and thus make these a better buy in Afghanistan. We visited with both Peshawar Motors and Millat Tractors concerning the training of the mechanics in Massey-Ferguson's Authorized Workshops. Both organizations are willing to assist here or in Lahore in the training of Afghan mechanics. Millat is also willing to provide VITA with a list of recommended tools for the workshop. VITA could pursue quantity discounts from Peshawar suppliers to permit individual trained mechanics to buy direct from the retailers. Providing free training offers less risk than free tools. The training will not be lost if the mechanic gives it to another or if he works more on lorries and motorcycles than on tractors. The mechanic's knowledge will be multiplied while free tools are not. Helping him get the right tools at a reasonable price is most desirable after he completes his training. A limited examination of the local market indicates that the majority of hand tools are Chinese and of reasonable quality.

8. Credit for crop production and farm machines probably belongs in the public sector whenever a stable government is formed. VITA might be able to provide some assistance in this area, but should make no loans. In the U.S., respected farmers can get loans for crop production and farm machinery from the government, local private banks, or John Deere. Some recent years Deere made money on their credit business while loosing money on their low sales volume. However, representatives from the office of the US-AID Representative pursued Millat Tractors about extending credit to Afghan farmers and they had no interest whatsoever in doing it. This is easy to understand if the stories we heard were true about Pakistan Agricultural Development Bank Loans to farmers for tractors. There is an entire bazaar for 'almost new' tractors adjacent Millat Tractors. A significant number of farmers with 5-10 acre farms get the government loan and drive away with an MF 240 tractor for Rs. 146,500. Within a half kilometer the tractor is sold to a middle man for about Rs. 120,000. The farmer then goes to the used tractor market and gets a used tractor for Rs. 80,000 which is more than adequate for his small farm. The other Rs. 40,000 is available for other purchased farm inputs, a wedding, or improving his house. They say that the government has sufficient security and enforcement that all interest and principal is recovered but I think this issue could be questioned further. The 'almost new' tractor is purchased within the week for cash by either a Pakistani or Afghan farmer. I pursued the idea of

tractor loans furnished by the village money lender in Pakistan or Afghanistan. People claim this does not exist. I find that hard enough to believe that I think it deserves more examination. Twenty years ago the village money lender in India who charged 24% interest was an effective competitor with the government giving 8% loans. One Afghan trader, with whom VITA has been working over the last two years, said that he extended credit to his regional retail traders but made no loans to customers.

9. The Afghan farmer needs to be able to depend on remunerative prices for his crops prior to planting them if he is to invest in adequate purchased inputs. While traders should always be permitted in the market, only the government can set a floor on prices. Unlike the previous requirements for productive agriculture, the industrialized countries do not have a good solution to insure reasonable prices to farmers. There is currently a great debate between the U.S. and E.E.C. over excessive farm subsidies distorting the market on both sides. VITA at the most can furnish some information on world prices and look for some success stories in other countries. India's Green Revolution was based on known remunerative prices for wheat as well as improved production technolgies.

10. Access to markets is essential if production is to increase. VITA can help to some extent with road projects but should avoid most heavy equipment. Private traders will probably take care of the need for lorries. Much of the grain will be moved for some distance by tractor and trolley. VITA can at least set an example of properly matching the trolley size to the tractor to insure both safety and life of the equipment.

<u>Influences on the Rate of Adoption of Improved Technologies</u>

<u>Factor Under Consideration</u> a) Rapid Adoption Example b) Slow Adoption Example	<u>Discussion</u>
Available in various sizes or quantities	
a) Seed and fertilizer	Seed and fertilizer is divisible down to 1 kg sizes so can be used by even the smallest farmer.
b) Mechanical farm power	The best real farm tractor in Pakistan has 50 engine hp. Reductions in power reduce work capacity faster than cost is reduced. This tractor can reach the small farmer through custom work, however.

Benefit obvious to buyer	
a) Irrigation	Assured water provides immediate plant survival and later increased yields.
b) Drainage	The need for drainage increases slowly with each year of irrigation, and may not be seen the first year at all.
Benefit obvious to buyer	
a) Cultivator	Cultivator prepares the land the way it has always appeared and does it rapidly.
b) Chisel plough	This is a slow operation that has not been done before nor have its benefits been seen or proven to Afghan farmers.
Benefit is timely	
a) Cultivator	The benefit of the cultivator is the same day it is used.
b) Seed drill	Some benefit of the drill may be seen upon germination after 1-2 weeks but the real benefit must wait for harvest and may require measurement to detect.
Payback complete in season	
a) Seed and fertilizer	The farmer gets his investment returned the same season and can discontinue the practice if it is unprofitable.
b) Tractor	Requires several years to generate enough income to pay off loan.
Completes a traditional task	
a) Thresher	A thresher eliminates preparation of the threshing floor, bullock trampling, and winnowing when the wind is suitable.
b) Reaper	A reaper only cuts and windrows the grain. Laborers are still required to gather the grain, bundle it, transport it, and stack it.

Provides the desired results

a) Thresher	Thresher provides clean grain and a pile of bhusa (finely split straw or chaff).
b) Combine	A combine provides clean grain but loses the bhusa which has 10-15% of the crop's value as cattle feed on the farm or can be sold.

Related changes required

a) Thresher	Thresher fits neatly into the traditional farming system.
b) Combine	For efficient use and long life, a combine needs parallel bunds with cross bunds eliminated or removed. Rapid grain handling must also be provided. This requires changes in various agronomic practices.

Minimum skill to use & maintain

a) Rear blade	The hitching and operation of a rear blade is obvious and no adjustments are required. No lubrication is required and the only part to replace is the blade.
b) Reaper	Hitching a reaper to a tractor requires several bolted connections, a powershaft to be installed, and a belt to be tightened. Operation requires cutting in a pattern around the field and keeping the height adjusted properly. Several parts require adjustment and lubrication. Multiple cutting parts must be sharpened and/or replaced.

Transport capacity and range

a) Tractor trolley	Has high volume and load capacity and can reach distant markets in a single days journey.
b) Improved bullock cart	Even a rubber tyred bullock cart is still limited by the speed and power of bullocks.